

What is claimed is:

1. A slurry used in a chemical mechanical polishing (CMP) process for ruthenium titanium nitride (RTN) thin film, the slurry comprising : ceric ammonium nitrate $[(\text{NH}_4)_2\text{Ce}(\text{NO}_3)_6]$.

2. The slurry according to claim 1 further comprising an abrasive and an acid.

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3. The slurry according to claim 2, wherein ceric ammonium nitrate is present in an amount ranging from about 1 to about 10% by weight of the slurry composition.

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4. The slurry according to claim 2, wherein the acid is selected from the group consisting of HNO_3 , H_2SO_4 , HCl , H_3PO_4 , and mixtures thereof.

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5. The slurry according to claim 4, wherein HNO_3 is present in an amount ranging from about 1 to about 10% by weight of the slurry.

6. The slurry according to claim 2, wherein the abrasive is selected from the group consisting of CeO_2 , ZrO_2 , Al_2O_3 and mixtures thereof.

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particles

inorganic particles of the

7. The slurry according to claim 2 or 6, wherein the size of the abrasive is below 1 μ m.

8. The slurry composition according to claim 2
5 or 6, wherein the abrasive is present in an amount ranging from about 1 to about 5% by weight of the slurry.

9. The slurry composition according to claim 2, wherein pH of the slurry ranges from about 1 to about 7.

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10. The slurry composition according to claim 9, wherein pH of the slurry ranges from about 1 to about 3.

11. The slurry according to claim 2, further
15 comprising a buffer solution.

12. The slurry according to claim 11, wherein the buffer solution comprises a mixture of organic acid and organic acid salt.

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13. The slurry according to claim 12, wherein the buffer solution comprises a mixture of acetic acid and acetic acid salt.

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14. A method for forming a RTN pattern
comprising:

(a) preparing a semiconductor substrate where a RTN
thin film is formed; and

5 (b) patterning the RTN thin film according to a CMP
process using a slurry of claim 2.

15. The method according to claim 14, wherein RTN
thin film is a barrier film.

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16. The method according to claim 14, wherein
step (b) is performed under a polishing pressure ranging
from about 1 to about 4psi.

15 17. The method according to claim 14, wherein
step (b) is performed by using a rotary type CMP system,
and a table revolution number thereof ranges from about
10 to about 80 rpm.

20 18. The method according to claim 14, wherein
step (b) is performed in a linear type CMP system where a
table movement speed ranges from about 100 to about 600
ft/min.

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19. A method for manufacturing a semiconductor device comprising:

(a) forming an interlayer insulating film on a semiconductor substrate having a predetermined lower
5 structure;

(b) patterning the interlayer insulating film to form an interlayer insulating film pattern having a contact hole;

(c) filling the contact hole with conducting
10 material and performing over-etch to form a recess contact plug;

(d) depositing a RTN thin film on the surface of the resultant structure; and

(e) forming a RTN thin film pattern on the recess
15 contact plug by performing a CMP process using a CMP slurry of claim 2.

20. The method according to claim 19, wherein the conducting material of step (c) is polysilicon.

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21. The method according to claim 19, further comprising the step of forming silicon nitride on the interlayer insulating film at the step (a).

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22. The method according to claim 19, further comprising the step of forming a buffer film between the contact plug and RTN film pattern.

5 23. The method according to claim 22, wherein the buffer film is titanium silicide.

24. The method according to claim 19, further comprising:

10 (f) forming a sacrificial insulating film pattern which opens the contact plug;

 (g) forming a lower electrode film on the resultant structure and performing a CMP process using the sacrificial insulating film pattern as an etch barrier to
15 obtain a lower electrode pattern; and

 (h) sequentially forming a dielectric film and an upper electrode on the resultant.

25 25. The method according to claim 24, wherein the lower electrode is a ruthenium film.

26. The method according to claim 24, wherein the dielectric film is a $(\text{Ba}_{1-x}\text{Sr}_x)\text{TiO}_3$ film.

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27. The method according to claim 25, wherein the ruthenium film is patterned by performing CMP process using the slurry of claim 2.

5 28. A semiconductor device manufactured according to a method of claim 19.